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ABSTRACT

The effectiveness of a workbook for training creative thinking, "Thinking Creatively: A Guide to Training Imagination," was evaluated with a sample of 198 inner-city students. The materials seek to teach attitudes which predispose an individual to behave more creatively and techniques for producing new combinations of ideas. Two sixth-grade classes (one from a low- and one from a medium-ability school) and two eighth-grade classes (one low- and one medium-ability) served as experimental groups. Four similar classes comprised the control groups. Three subtests from the Torrance Tests of Creative Thinking were administered to all subjects (Ss) as pretests. After about four weeks of training (one class hour on each of about 20 days), another form of the Torrance Test was given, along with a 20-item attitude questionnaire for all Ss, plus two other instruments just for students and teachers in experimental classes. Despite the finding that both the training materials and the testing instruments were difficult for many of the Ss to read and thoroughly comprehend, most students and teachers felt that students had benefited from the creativity training experience. Two experimental classes showed modest gains in Torrance Test scores. (Author/JM)

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Technical Report No. 224

A PROGRAM FOR TRAINING CREATIVE THINKING: INNER CITY EVALUATION

by

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Report from the
Task and Training Variables in
Human Problem Solving and Creative Thinking Project

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Statement of Focus

The Wisconsin Research and Development Center for Cognitive Learning focuses on contributing to a better understanding of cognitive learning by children and youth and to the improvement of related educational practices. The strategy for research and development is comprehensive. It includes basic research to generate new knowledge about the conditions and processes of learning and about the processes of instruction, and the subsequent development of research-based instructional materials, many of which are designed for use by teachers and others for use by students. These materials are tested and refined in school settings. Throughout these operations behavioral scientists, curriculum experts, academic scholars, and school people interact, insuring that the results of Center activities are based soundly on knowledge of subject matter and cognitive learning and that they are applied to the improvement of educational practice.

This Technical Report is from the Task and Training Variables in Human Problem Solving and Creative Thinking Project in Program 1. General objectives of the Program are to generate new knowledge about concept learning and cognitive skills, to synthesize existing knowledge, and to develop educational materials suggested by the prior activities. Contributing to these Program objectives, this project is focused on investigating creative problem solving as a trainable cognitive skill. The development and testing of creative thinking programs follows research on basic problem-solving variables in different situations.

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Abstract

The effectiveness of a workbook for training creative thinking, Thinking Creatively: A Guide to Training Imagination, was evaluated with a sample of 198 inner-city students. The materials seek to teach attitudes which predispose an individual to behave more creatively and techniques for producing new combinations of ideas.

Two sixth-grade classes (one from a low- and one from a medium-ability school) and two eighth-grade classes (one low- and one medium-ability) served as experimental groups. Four similar classes comprised the control groups. Three subtests from the Torrance Tests of Creative Thinking were administered to all Ss as pretests. After about four weeks of training (one class hour on each of about 20 days), another form of the Torrance Tests was given, along with a 20-item attitude questionnaire for all Ss plus two other instruments just for students and teachers in experimental classes.

Despite the finding that both the training materials and the testing instruments were difficult for many of the Ss to read and thoroughly comprehend, most students and teachers felt that students had benefitted from the creativity training experience. Two experimental classes showed modest gains in Torrance Test scores; Ss in all four experimental classes displayed more creative attitudes as indexed by a number of items in the 20-item attitude survey. It was recommended that future efforts to teach or test for creativity in the inner city accommodate the reading level and perhaps even cultural experiences common to this population. It also was recommended that teachers allow for more active participation in classroom problem-solving activities.

I
Introduction

Creative ability, as with other human abilities, must be a product of both innate capacity and learning. And although there is little we can do to alter the genetic component of creativity, growing evidence indicates that some creative problem-solving skills definitely can be trained. Training in creative problem solving not only enhances an individual's creative capacity, but usually increases his self-confidence and leads him to be more flexible and receptive to innovative thinking.

The Creativity Project of the Wisconsin Research and Development Center for Cognitive Learning has been profitably guided, both in laboratory research and in the development of classroom materials, by a three-part model of creativity. This model serves to simplify the frankly obscure nature of "creativity" and to clarify which of the many faces of creativity may, in fact, be improved through deliberate training.

Creativity is conceptualized as consisting mainly of three components: (a) appropriate creative attitudes, the most critical of which is a favorable attitude toward highly imaginative ideas, (b) various cognitive abilities, which facilitate whatever mental abstracting, combining, perceiving, and associating contribute to the fluent production of original problem solutions, and (c) techniques for the conscious and systematic production of new combinations of ideas. The focus of the R & D Creativity Project has been upon teaching attitudes conducive to creative behavior as well as some techniques for generating new ideas.

Attitudes

Attitudes may be defined as learned, emotionally-toned predispositions to react consistently, favorably or unfavorably, toward persons, objects, or ideas (Klausmeier & Goodwin, 1966, p. 343). Creative individuals possess particular attitudes—broadly defined to include conscious "awarenesses" and "sets"—which are absolutely indispensable for a flexible, productive imagination. The most important attitude contributing to creativity is simply a favorable attitude toward highly imaginative ideas. Almost by definition the most creative innovations in any field are unusual, perhaps "far-fetched" ideas. Historically, the horseless carriage, flying machine, and Fulton's Folly all were judged ridiculous and impractical. It goes without saying that an appreciation for imaginative ideas includes a receptiveness to the creative ideas of others, an attitude reflected in the well-known deferred-judgment principle of brainstorming (Osborn, 1963).

Another important, yet teachable, attitude has been named "constructive discontent"—the notion that anything can be changed for the better. Creative individuals, quite aware of the importance of innovation in our fast-changing society, often deliberately look for improved ways to do things, questioning the status quo. Finally, a particularly helpful attitude is the belief that one can become a more effective, creative thinker.

Techniques

Creative thinking techniques are procedures for consciously and deliberately producing new combinations of ideas--without waiting for an unpredictable "inspiration." Four of these problem-solving strategies will be briefly described in this section: (a) attribute listing, renamed the "part-changing" method by Davis and Houtman (1968), (b) the morphological syn-

thesis or "checkerboard" method, (c) checklisting, and (d) the synectics or "find-something-similar" method.

The attribute-listing (Crawford, 1954) or part-changing technique is a simple and effective method for generating creative ideas to improve or change virtually anything. Using this method, teachers might ask students to itemize important attributes (or parts) of a product and then consider each attribute as a source of potential change or improvement. For example, with an object as simple as classroom chalk, students might learn to identify the attributes of size, shape, color, and material. Then, by considering changes for each of these individual attributes, ideas for a large variety of chalk may be quickly produced. "Objects" in art, literature, science, business, and industry, for example, may be improved with this method. Attribute listing both sensitizes students to various properties of objects and equips them with a simple yet very productive means of innovation.

With the morphological synthesis (Allen, 1966) or checkerboard (Davis & Houtman, 1968) method, students first identify two or more important characteristics or dimensions (e.g., color, shape) of a problem and list specific values (e.g., red, blue, green; square, round, triangular) for each. They then examine all possible combinations, utilizing one value of each characteristic. For example, if students are asked to "invent" a new line of pop-up toasters, all combinations of 15 shapes, 20 different colors and color patterns, and 5 sizes would instantly produce 1500 possible products. The morphological-synthesis technique invariably produces an enormous quantity of idea combinations in a very short time and guarantees the production of idea combinations never before considered.

With the checklist procedure (Osborn, 1963), students consider each item on a prepared list as a possible source of innovation in respect to a given problem. In the classroom, for example, they may be taught to consult a history book as a "checklist" of ideas for writing themes or short stories. Faced with the problem of selecting a career, they might consult the Yellow Pages, a checklist containing thousands of vocational suggestions. Likewise, a department store catalogue would provide a checklist of ideas for solving a gift-giving problem.

The synectics (or "find-something-similar") method (Gordon, 1961) mainly emphasizes the use of metaphors and similes, especially those drawn from nature. After posing a problem, teachers encourage students to ask how animals, insects, or even plants have solved similar problems. Solutions for a parking problem, for example, may be found by considering how bees or ants "store things." Proposing ideal but apparently ridiculous problem solutions, such as having insects work on command to solve a transportation problem, is another synectics method for stimulating new viewpoints on a problem. "Playing with" or free-associating word meanings may lead to still more new ideas. For example, speculating on the meaning of the word "opening" (cutting, prying, unfolding, etc.) may suggest new designs for a can opener (Gordon, 1961).

A Program for Training Creative Thinking

Thinking Creatively: A Guide to Training Imagination (Davis & Houtman, 1968) is a program designed to develop the creative potential of sixth, seventh, and eighth graders by teaching the attitudes and procedures described above. The program is in the form of dialogue among four characters. Mr. I is a backyard scientist-inventor who tries to teach the other three characters various principles and procedures for creative problem solving. Dudley Bond is a young neighbor of Mr. I's. While a bit awkward at times, Dudley displays a fine sense of humor and enjoys the challenge of finding ideas for solving problems. Maybelle is Dudley's cousin who needs help in learning to find ideas. Last, but hardly least, is Max, a professional bear who, being the clown of the program, rarely understands anything very clearly. He often displays an uncreative mean streak and freely criticizes some of the "nutty" ideas—allowing the others frequent opportunity to repeat important principles of creative problem solving.

Throughout ten chapters, Mr. I explains the creative problem-solving procedures and attitudes likely to aid in solving a given problem, and Dudley, Maybelle, and sometimes Max use the principles to solve numerous simple and complex problems. At the end of each chapter, principles are reviewed and several exercises are presented for the student to complete. More detailed information regarding purposes and contents of the program may be found in Davis (1969, 1971a), Davis and Houtman (1968), and Davis, Houtman, Warren, and Roweton (1969).

The Preliminary Field Test

The first version of Thinking Creatively was pilot tested in an upper-middle-class junior high school (average school IQ = 115) located in a Chicago suburb (see Davis, Houtman, Warren, & Roweton, 1969). The experimental group was comprised of 23 Ss (21 seventh- and 2 eighth-grade students) who studied the program in a ten-week creative thinking course. Thirty-two seventh-grade students enrolled in a creative writing course served as control Ss. On three brief, divergent production tasks (thinking of changes and improvements for a door knob, inventing new kinds of hot dogs, and listing unusual uses for a coat hanger), Ss in the experimental group produced 50%, 54%, and 91% more ideas than did Ss in the control group. Also, the ideas of the trained Ss were rated as significantly more "creative" than those of the control Ss. Responses to an attitude questionnaire, while not overwhelmingly strong nor completely unambiguous, definitely suggested that the experimental Ss did indeed feel more creative, more appreciative of imaginative ideas, and more consciously aware of the importance of change and innovation.

While there were minor difficulties in the interpretation of the favorable results, the field test did serve its two purposes in (a) providing preliminary positive evidence for the effectiveness of the program and (b) suggesting improvements for the program itself, e.g., adding more exercises to several chapters and shortening two tediously long chapters. The revised program was ready for a larger validation study, with a more varied population.

II
Present Field Test

In the earlier field test (Davis, Houtman, Warren, & Roweton, 1969), Thinking Creatively was shown to improve scores on divergent thinking tests and strengthen creative attitudes in above-average seventh-grade students. The present evaluation sought to test the program with a wider age group and to examine its effectiveness with average and below-average students. Accordingly, a 2 x 2 x 2 experimental design allowed for two age groups (sixth- and eighth-grade students), two ability levels based upon the average IQ of the school ("average" and "low"), and two treatment levels (experimental and control Ss).

As before, the two types of testing instruments were (a) short, divergent-thinking tests and (b) an experimenter-designed attitude survey. However, instead of using our own idea-production tests, as in the earlier field study, several subtests of the Torrance Tests of Creative Thinking (TTCT; Torrance, 1966a) were administered. This change seemed desirable since (a) two forms of the TTCT were readily available—a necessity for a "before-after" study (the first field test was "after" only), (b) scoring of the TTCT was standardized and likely to be more reliable than our own scoring methods, and (c) two of the three tests to be used were essentially identical to two tests used earlier (our earlier test asked S to think of improvements for a door knob, while the Torrance subtests asked for improvements for a stuffed monkey/elephant; our test asked for unusual uses for a hanger, and the Torrance subtests asked for unusual uses for tin cans/boxes). The present 20-item attitude survey is a minor modification of the 18-item instrument used earlier.

Finally, teachers and students in the experimental group were questioned further regarding their reactions to the program (Thinking Creatively), perceived benefits of the training, the conduct of the classes, weaknesses in the materials, and anything else upon which they wished to comment.

III
Method

Subjects

The present 2 x 2 x 2 experimental design required two classes, experimental and control, in each of four schools: (a) a low-ability elementary school (sixth-grade Ss); (b) a medium-ability elementary school (sixth-grade Ss); (c) a low-ability junior high school (eighth-grade Ss); and (d) a medium-ability junior high school (eighth-grade Ss).

Participating schools and classes were randomly selected from average and low strata schools (based upon mean school IQ) with two constraints. First, all teachers were interested and willing volunteers. Second, the two elementary schools were "feeder" schools to their respective junior high schools. The first constraint was a practical necessity; the second helped insure homogeneity of Ss within each ability group.

Since the four sixth-grade classes were self-contained, the two experimental and two control classes were taught by four different teachers. With the rotating eighth-grade classes, two teachers taught both an experimental and a control class. With the medium-ability eighth-grade Ss, the experimental group was a mathematics class whose regular math assignment was postponed for four weeks; the control group was a similar math class. In the low-ability eighth-grade school, both the experimental and the control groups were social studies classes.

The final sample sizes (and the experimental design) appear in Table 1, after the data were discarded for Ss who did not complete all pretests and posttests.

Table 1
Final Sample Sizes for Experimental and Control Classes
(Total N = 198)

	Treatment			
	Experimental		Control	
Grade	Low Ability	Medium Ability	Low Ability	Medium Ability
Sixth	28	26	28	26
Eighth	19	24	25	22

Materials

The training materials consisted of the program, Thinking Creatively: A Guide to Training Imagination, by Davis and Houtman (1968), described in Section I.

Procedure

At the time this study was initiated, the authors did not strongly prefer any one specific method of teaching or completing exercises over any other. Consequently, teachers of the four experimental classes exercised complete freedom in both of these matters. Later, teachers described both verbally and in a formal follow-up questionnaire precisely how the classes were taught and the exercises administered.

Based upon the earlier field test, teachers were asked to conduct daily 50-minute classes for four weeks. One eighth-grade teacher extended the training to about seven weeks since her class met only three times per week. Overall, the 20 experimental class periods allowed about two classes for each of the ten chapters of the workbook.

Regarding testing, all eight classes were pretested with three subtests of the Torrance Tests of Creative Thinking (TTCT), Form B, and posttested with Form A of the TTCT, in accord with instructions in the Directions Manual and Scoring Guide (Torrance, 1966b). The attitude survey was used in an "after only" fashion, with Ss in all eight classes responding to the questionnaire at the end of the training period. Additional questions for students and teachers in the experimental classes also were answered at the end of the training period.

Measuring Instruments and Dependent Measures

The 20-item attitude questionnaire, modified slightly from the version used in the earlier study, appears in Appendix A. This questionnaire sought to determine Ss' appreciation for and receptivity to imaginative ideas, their awareness of creativity and innovation, and their perception of their own creative capacity. Instructions on the cover of the questionnaire advised students, "These questions deal with how you feel about new ideas and thinking. For each question, place a checkmark in the blank which best describes the degree to which you think that the statement is true. There are no 'right' or 'wrong' answers, just be honest." A nine-point scale, in the form of nine numbered blanks, appeared after each of the 18 questions. Three of the scale points—1, 5, and 9—were labelled "Never True" (1), "One-Half True" (5), and "Always True" (9).

Three subtests of the TTCT (Torrance, 1966a) were used: (a) Product Improvement (10 min.), which asks S to "...list the cleverest, most interesting and unusual ways you can think of for changing this toy elephant (or toy monkey) so that children will have more fun playing with it."; (b) Unusual Uses (10 min.), requiring S to "...list as many...interesting and unusual uses for cardboard boxes (or tin cans) as you can think of."; (c) Just Suppose (5 min.), asking S to "...JUST SUPPOSE that clouds had strings attached to them which hang down to earth. What would happen?" or "...JUST SUPPOSE a great fog were to fall over the earth and all we could see of people would be their feet. What would happen?" Tests were scored according to instructions in the Directions Manual and Scoring Guide (Torrance, 1966b), producing for each test and each S a measure of fluency (number of ideas), flexibility (number of categories of ideas), and originality (idea uniqueness).

The two attitude-and-information "instruments" pertaining to the training program and its administration and effects appear in Appendix B (for experimental Ss) and Appendix C (for teachers of experimental Ss).

IV
Results

Creativity Tests

For each S, scores for the three Torrance Tests were combined to produce total fluency, total flexibility, and total originality scores for the pretests as well as for the posttests. Since improvement in creativity was of prime concern, gain scores (from pre- to posttesting) were subjected to a multivariate analysis of covariance, using pretest scores as the covariate.

Gain scores for all eight experimental treatment combinations are shown in Figure 1. The data are not as orderly as anticipated. Overall, two experimental classes (sixth-grade low-ability, and eighth-grade medium-ability) and one control class (sixth-grade medium-ability) appear to show some gains in Torrance Test scores.

Tables 2, 3, and 4 summarize the results of the multivariate analysis of covariance for the fluency, flexibility, and originality gain

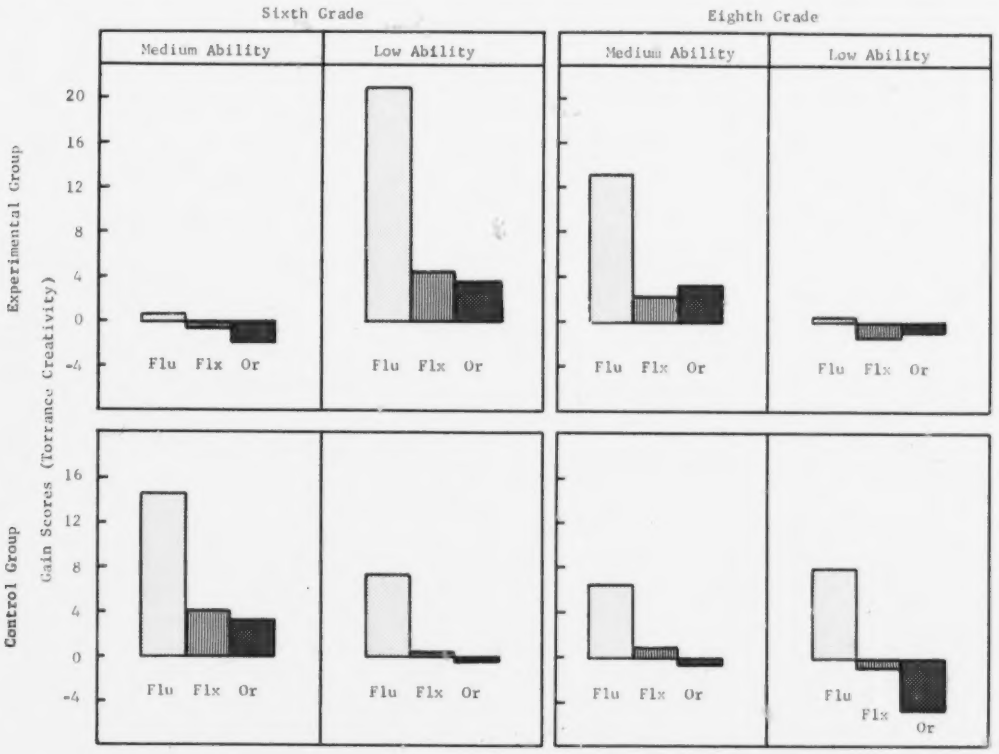

Fig. 1. Fluency, flexibility, and originality gain scores (posttest Torrance creativity scores minus pretest scores) as a function of treatment, grade, and school ability level.

scores. The critical main effect of Treatment (experimental vs. control Ss) did not reach significance for any of the three measures. Grade effects did reach significance, favoring sixth-grade Ss, since two of the three groups showing gains were sixth-grade classes (one experimental, one control). Treatment by Grade interactions were nonsignificant for the three measures.

Considering just sixth-grade Ss, the finding that low-ability experimental and medium-ability control Ss showed improvement is reflected in significant Treatment x School/Grade 6 interactions. Also, the fact that medium-ability experimental eighth-grade Ss showed improvement led to significant School/Grade 8 variance sources. With just the fluency measure, there also were significant school differences within sixth grade, favoring the low-ability school. With eighth grade, a significant Treatment x School/Grade 8 interaction reflected the substantial gains by the medium-ability eighth-grade experimental Ss.

As we will see in the Discussion section (Section V), in light of the particular teaching methods, student population, and conceivable test insensitivity, most of the above results may be meaningful. The one totally unexplainable outcome, of course, was the improvement shown by medium-ability sixth-grade control Ss.

Table 2
Multivariate Analysis of Covariance
on Fluency Gain Scores

Source	df	F	p <
Treatment	1	.27	.61
Grade	1	4.39	.04
School/Grade 6	1	6.52	.01
School/Grade 8	1	3.01	.08
Treatment x Grade	1	.09	.76
Treatment x School/ Grade 6	1	22.33	.00
Treatment x School/ Grade 8	1	2.84	.09
Error	189		

Attitude Questionnaire

Students in all eight participating classes responded to the 20-item attitude questionnaire (Appendix A) at the end of the training period. Ratings on the 20 nine-point scales, from a total of 198 students, were analyzed by a 2 x 2 x 2 multivariate analysis of variance with 20 dependent measures.

Table 3
Multivariate Analysis of Covariance
on Flexibility Gain Scores

Source	df	F	p <
Treatment	1	.05	.82
Grade	3	3.72	.06
School/Grade 6	3	.44	.51
School/Grade 8	3	4.77	.03
Treatment x Grade	3	.00	.97
Treatment x School/ Grade 6	3	14.47	.00
Treatment x School/ Grade 8	.3	.44	.50
Error	187		

Table 4
Multivariate Analysis of Covariance
on Originality Gain Scores

Source	df	F	p <
Treatment	1	1.58	.21
Grade	1	1.38	.24
School/Grade 6	1	.89	.35
School/Grade 8	1	9.68	.00
Treatment x Grade	1	2.30	.13
Treatment x School/ Grade 6	1	8.97	.00
Treatment x School/ Grade 8	1	.01	.91
Error	189		

Regarding Treatment effects, seven of the 20 attitude items reached significance at or beyond the .05 level (Table 5); one of these seven items (No. 6) showed the control mean to be "more creative" than the mean of the experimental group.

The remaining six items present some evidence that the trained Ss had acquired an appreciation for imaginative ideas (Items 5, 8, 13, and 14), had learned that most anything can be changed for the better ("constructive discontent" attitude, Item 1), and had learned that new ideas are important (Item 11).

Regarding the main effect of Grade level upon responses to the attitude questionnaire, only Item 11 showed a significant difference between sixth- and eighth-grade students, $F(1,190) = 5.92$, $p < .01$. Eighth-grade students tended to appropriately disagree with the asser-

Table 5
Attitude Questionnaire Items Showing Treatment Effects

Item	Experimental Mean (9-point scale)	Control Mean (9-point scale)	F	p <
1. Just about anything in the world could be changed for the better.[a]	6.54	5.62	8.75	.004
5. Creative thinkers do not spend time on wild ideas.[b]	3.61	4.93	10.72	.001
6. I often think about new ideas.[a]	6.06	6.81	5.45	.02
8. Unusual or wild ideas are usually of no help in solving a serious problem.[b]	3.74	4.77	8.55	.004
11. Writers, scientists, and engineers need new ideas, but the average worker doesn't.[b]	3.53	4.26	3.68	.05
13. Wild ideas can sometimes lead to good ideas.[a]	8.00	6.91	15.43	.0002
14. It's best to make sure an idea is a good one before suggesting it to a group.[b]	6.18	7.02	5.32	.02

[a]A higher mean rating is "more creative."
[b]A lower mean rating is "more creative."

Table 6
Attitude Questionnaire Items Showing Effects of Average School Ability

Item	Low-Ability Group Mean (9-point scale)	Medium-Ability Group Mean (9-point scale)	F	p <
3. When solving problems, thinking of lots of possible ideas is better than sticking with just one that seems right.[a]	5.86	6.68	5.02	.02
5. Creative thinkers do not spend time on wild ideas.[b]	4.63	3.93	3.92	.05
9. Just a few people have the mysterious ability to find really good, new ideas.[b]	5.31	4.45	4.72	.03
11. Writers, scientists, and engineers need new ideas, but the average worker doesn't.[b]	4.48	3.31	8.60	.003
12. Sometimes I am afraid my ideas might be laughed at.[b]	5.54	6.33	4.27	.04
17. I often look for better ways of doing things.[a]	7.23	6.63	4.42	.03
20. I think I am adventurous.[a]	5.78	7.06	16.48	.0001

[a]A higher mean rating is "more creative."
[b]A lower mean rating is "more creative."

Table 7

Responses to "More Questions" by Experimental Subjects (Items 1-6)

Item	Sixth Grade						Eighth Grade					
	Low Ability			Medium Ability			Low Ability			Medium Ability		
	False	Partly true	True	False	Partly true	True	False	Partly true	True	False	Partly true	True
1. Since reading "Thinking Creatively," I understand where many new ideas come from.	3	9	17	5	8	13	2	9	12	1	13	13
2. Since reading "Thinking Creatively," I can see how important new ideas are in the world.	2	6	22	3	11	12	2	8	13	1	3	23
3. Since reading "Thinking Creatively," I believe I am more creative than I used to be.	5	9	14	6	8	12	5	5	12	2	10	15
4. Now that I've read "Thinking Creatively," I am more interested in new discoveries and inventions than I was before.	4	6	19	4	6	3	2	15	6	4	11	12
5. Now that I've read "Thinking Creatively," I think about new ideas more than I used to.	5	5	19	6	15	5	5	10	8	2	14	11
6. Since reading "Thinking Creatively," I can see more need for new ideas than before.	4	10	15	3	11	12	6	5	11	2	9	16

Table 8
Responses to "More Questions" by Experimental Subjects (Items 7-11)

Item	Sixth Grade						Eighth Grade					
	Low Ability			Medium Ability			Low Ability			Medium Ability		
	No	Sometimes	Yes	No	Sometimes	Yes	No	Sometimes	Yes	No	Sometimes	Yes
7. Was the program, "Thinking Creatively," difficult to read?	18	9	2	13	11	2	14	7	1	23	4	0
8. Was the program, "Thinking Creatively," difficult to understand?	19	7	1	11	13	2	9	9	2	16	10	1
9. Were the exercises too difficult?	18	3	7	9	14	2	12	5	2	18	8	1
10. Compared with other books or workbooks, did you find the program interesting?	0	8	21	5	2	18	5	2	18	5	5	10
11. Compared with other books or workbooks, did you find the program enjoyable?	4	9	16	3	8	15	2	9	9	1	6	20

tion that "Writers, scientists, and engineers need new ideas, but the average worker doesn't."

Differences due to average school ability, the third main effect, appeared on seven attitude items (Items 3, 5, 9, 11, 12, 17, and 20; see Table 6). The medium-ability Ss scored in the more creative direction on five of the seven items (3, 5, 9, 11, and 20). Low-ability Ss scored higher in creativity on Items 12 and 17.

The results attributable to Grade and Ability main effects do not seem to have any special significance except, perhaps, in the trend for medium-ability Ss to score in a "more creative" direction more often than low-ability Ss.

Additional Questions for Experimental (Trained) Students

Students in the four experimental classes (low-medium ability, sixth-eighth grade) responded to the 11 "More Questions" shown in Appendix B and Tables 7 and 8. Table 7 indicates that a very sizeable proportion of the students felt they were positively influenced by the training experience. A majority of students felt they were "more creative" than they used to be ("True" responses to Item 3); just 16% admitted they did not feel more creative as a result of the training. Similarly, a majority of the students agreed that, since reading the program, they better understood the sources of new ideas (Item 1); they realized the need for and importance of new ideas (Items 2 and 6); and they are more interested in and more often think about new ideas than before the training.

Students' reactions to the readability, difficulty, and interestingness of the program appear in Table 8. Again, the pattern of responses is similar across the four classes. The majority of students indicated that the material was interesting, enjoyable, and not too difficult to read or understand. The latter conclusion, in view of teacher reports, is suspect.

Additional Questions for Teachers of Experimental Classes

Some of the most enlightening facets of the present research are found in the teachers' responses to the postexperimental questionnaire (Appendix C). Their comments pertain to the suitability of the tests (Attitude Questionnaire and the Torrance Tests) and the appropriateness and effectiveness of the training program, Thinking Creatively, for their students.

Before proceeding, it must be noted that while the low-ability classes seem accurately characterized (their schools were randomly selected from those schools at the lowest average IQ strata in Milwaukee), the medium-ability classes probably should be considered "low-medium" in ability. The two medium-ability schools, one junior high and one elementary, are located on the fringe of the "inner city." The median IQ of one "medium-ability" experimental class was 91, with a range of 76-109. (Figures for the other medium-ability experimental class, located nearby, were not available.) The point is, all four experimental classes contain many low-ability students, and the comments of all four teachers are thus relevant to teaching for creativity with disadvantaged, slow-learning, inner-city students with these materials, and measuring with these instruments.

Below are excerpted responses to some of the items in the teachers' questionnaire. The four classes will be identified by grade number (6 or 8) and mean ability of the school (L or M); for example, "6L" will identify a teacher's comments pertaining to his or her sixth-grade, low-ability students. The reader should keep in mind that 6L and 8M were the two experimental classes showing moderate gains in Torrance Test scores.

A. Attitude Questionnaire(s)

1. a. Did you read the attitude questionnaire items to the class?

   b. Did students seem to understand the questions? The procedure?

   c. Were some/any of the items unclear?

6L (a) Yes.

(b) I am sure that they understood the questions to a degree, as well as the procedure. On the other hand, in everyday experience students constantly fail to hear, heed, or follow directions or instructions for reasons of their very own. I have been unable to determine the "why." They made an effort to follow the prescribed procedure to the best of their understanding.

(c) No doubt, some at least.

6M Many of the children had never before seen some of the words used in the questionnaire. They were puzzled and I found it necessary to read the entire questionnaire, explaining as we went along. The method of recording responses seemed peculiar to them. I fully explained this with a diagram on the board. I read each item for them, pausing long enough for them to record their responses.

8L (a) I read the first sheet of the questionnaire to the class and had a few of them answer these questions orally. I don't really think they realized that we like or dislike things in unequal amounts. To them, there were too many choices which they are not used to making. My students see everything in either an extreme yes or no context.

(b,c) Please remember that these students can be classified as non-readers and I really doubt that the whole class understood; I don't believe that any of the items would be unclear to "average" eighth-grade readers.

8M (a) I read the first page only so the students could practice the examples and begin to learn the style of answering.

(b) I assumed they understood the questions because no one asked for help in reading or interpretation. However, I know one student in the "experimental class" that could not read higher than the third-grade level. He probably guessed the various degrees.

2. Do you think that students answered according to what they thought should be the "right" answer? Or do you feel that they tried to be as truthful as possible?

6L Both. However, the majority tried to be truthful.

6M At the time, I remember telling the class to be as truthful as possible—and I'm sure that they were.

8L Knowing the class, I think they would have been looking for the "right" answer; remember that these kids have become so accustomed to being told what to do that they find it more than difficult to make independent judgments.

8M I reminded them several times to answer with "honest feeling," but I did not question them during or after the test.

B. Potpourri

1. How exactly (but in a sentence or two) did you use the program? (Did you read it to them or read it together as a class? Did the students read it at home on their own? Were the exercises done and/or discussed in class or did the student do the exercises on his own time? Did you or the students elaborate on or make up your own problems, using techniques in the program? Anything else?)

6L I read the entire book to them, since it was written at a higher level than they were able to read independently. They did the exercises independently, but not until we had discussed them together, using our own similar examples. ... We even had a taste testing experience using sandwich spreads which were combinations of unusual sorts: for example, peanut butter and cranberry sauce, applesauce and cream cheese, and about six others, each with a special name.

6M Because most of my sixth-grade students were slow readers with below grade-level comprehension, I found it necessary to read each chapter to the class and clarify words as we went along. The exercises were done and discussed in class under teacher direction. For the most part we elaborated on the problems in the workbook. However, after studying the chapter on problem-solving techniques, a few students suggested using the "checkerboard method" for finding ways to decorate the classroom and acquire new ideas for writing language themes.

8L I read some, and they read orally some of the chapters. [Sometimes they read] ...in groups of three or four. We made up a few exercises.

8M The "Dear Student" page was read together in class. I asked for questions. None came. Following that, they read the first chapter up to page 12 in class. We reviewed the meaning of the boxes and asterisks which emphasized generalizations and gave page 12 as a homework assignment. From then on all reading, listening and thinking were done in class or as homework, depending upon time. No penalties were given, and no comments were made if they didn't have lists read.

Information of individuals was pooled in class by appointing a chairman-secretary to write all different ideas on blackboard so all could copy, or make additions to their own lists. ... we voted on the most interesting, most marketable, most unique, most fun, or most anything else we found.

"Humor and fun" ran high. By the time we came to page 79 on the pop-up toaster, the class preferred to form groups, and wrote down ideas more quickly and came up with a product easily during class.

2. a. Was the program difficult for your students to read?

b. Did (most/all) students seem to understand the main principles and procedures?

c. Did they seem to enjoy the workbook (at least compared to other instructional materials)?

6L (a) Yes.

(b) Yes. Again, to a limited degree.

(c) Some, certainly, others I really don't think so. There was no right or wrong, consequently no visible reward. Competition is keen and grades are immediately compared—even report cards!

6M The program was difficult for the majority of my class to read. Some of the students (the average and above average) understood the main principles brought forth through class discussion. I'm sure they could have acquired the main ideas on their own. The slow learners needed much explanation. The slow learners (3/4 of the class) enjoyed the clever workbook characters and their antics. All of the children loved the illustrations.

8L (a) Yes.

(b) Few.

(c) I got the feeling they thought it was only something else they had to read; when they were reading in small groups I waited for a chuckle or two but there were none!

8M (a) No.

(b) Yes.

(c) Yes. Absences were not great. Many times students weren't aware of time. When students were told they could keep the manual if they wanted to, none were returned. The drawings appealed to many students who duplicated them on books and other materials.

3. Do you feel (most/all) students benefitted from the experience?

6L I would have to say yes. There is a question always as to how much they benefit from any experience. I really believe that those who tried benefitted as much or more from this experience as from any other that we tried.

6M I definitely feel that all of my students benefitted from the experience.

8L I have to be honest and say few. Perhaps 10% of them think of school as a place to learn; the others are there because they

have to be. And these 90%...have learned to think of school as a pretty frustrating place....

8M Yes.

4. Was there much discussion of either the particular chapter or the exercises?

6L As thorough as we could make it. Of course, there were the usual attempts to be a comedian, and when one tried to outdo the other, discussion was rerouted. It's one thing to urge ideas no matter how wild, and then control them this side of absurdity.

6M The children loved the chapters on the checkerboard method and also the part-changing method. Many children made their own lunch box models featuring their own novel ideas.

8L There would be some discussion as we would start, mainly because they wanted approval from me (grade-wise) as they wrote each line. As a group, discussion is almost impossible as they cannot bear to have someone else talking and so they constantly interrupt!

8M We spent an enthusiastic two days on page 118 because our school does have heavy traffic around the school. Therefore, this was tackled seriously. Some suggestions were: building tunnels, bridges, crossing in groups, directing students in walking patterns, detouring cars.

5. Any other general comments, qualifications, criticism, strong points, weak points, etc.?

6L Overall, I feel that the plan was excellent. The material probably should be graded for levels that will use it. I have saved the workbooks with the intention of reusing them. I was pleased to have participated and would be willing to do so again if asked.

6M On the whole, the workbook was very well done. It seems as though the language level is geared to average and above average, bright students. However, the characters and illustrations saved the workbook and aroused the interest of the slow students. Some of the activities are a little too difficult for the slow student to comprehend without teacher guidance.

The reading level is difficult and hard for slow, inner-city elementary children. This would be good enrichment for a fast group of readers.

8L I think the program is good but am wondering if the characters somehow couldn't be changed. Example: Main character could be "Mom" on welfare trying to make something out of nothing, skeptic could be neighbor next door who always "pans" inventiveness, inventor's sidekick could be eldest son who quickly learns to make do, etc. This language they could understand.

Also pertinent is that approximately 1/3 of this class is not passing either social studies or language arts because of their lack of basic skills.

8M I found a lack of or slowing down of attention as we came into the ninth chapter. That reading became difficult for some children. I could have taken another week—say 4 1/2 instead of 3 1/2 weeks—to complete the work. We did not cover the tenth chapter at all.

We did problems of our own choice using page 132 as a guide for procedure and solution. By class vote, after the secretary listed several problems to be solved, the problem was chosen; i.e., How can teenagers drive go-carts on city streets? Segments of problem were change in laws, machine, and clothing in order to drive go-carts safely.

V
Discussion

Certainly, the present field test of Thinking Creatively is not a clear-cut, glowing success. The workbook and the measuring instruments were difficult for many of these inner-city students to read and fully understand.

More positively, however, it also seems evident that many students did benefit from this creativity training experience, at least to a moderate degree. As described elsewhere (Davis, 1971a, 1971b), a major goal of any effort to "teach creativity" is to increase a student's "creativity consciousness," that is, his attitudes, awarenesses, and predispositions related to behaving in a more creative fashion. As indicated by the three questionnaires, most students and three out of four teachers seemed to feel that the experience indeed was worthwhile and beneficial in these "attitudinal" respects. Furthermore, two of the four experimental classes showed substantial gains in Torrance Test scores, despite the possibility that these tests may not have been the "best," most sensitive indicators of true creative growth.

It is noteworthy that, apparently independent of grade or ability, the two most successful classes (sixth-grade low-ability, and eighth-grade medium-ability) achieved a good creative climate. Students actively engaged in creative thinking, and their wild ideas were accepted; the teacher was supportive of creative thinking and sometimes served as a "model" of a creative person. A third experimental class, the sixth-grade medium-ability group, also seemed to possess this creative atmosphere, but no gains in Torrance scores were registered. The fault, of course, may lie with the measuring instrument rather than the creative growth of the class. Visits with this class "in action" gave every reason to believe students indeed were behaving quite creatively. They used one creative thinking technique to find ideas for writing themes and another method for finding ideas for decorating the room in an Oriental mode.

As for recommendations, it is evident that teaching for creative development in the inner city requires the following provisions:

1. Special training materials should accommodate at least the below-grade reading and comprehension levels, if not cultural traditions and thinking patterns common to this group. Clearly, the present research was plagued by training materials too sophisticated for many, but by no means all, of these students.

2. Tests must not only accommodate the reading, comprehension, and skill levels of this population, but at the same time must be relevant (and sensitive) to the content of the training experience. An instrument which is either too difficult for the Ss or inappropriate to the training experience will defeat a meaningful evaluation of any educational training experience, whether in creativity or any other area. It is difficult to say, in the present study, whether the Torrance Tests and the attitude surveys were the most valid and most sensitive instruments which could be used; they simply were the best available.

3. Very special attention must be given to the teacher conducting a creativity-training experience. Perhaps careful training would reduce innate teacher differences in their ability to stimulate creative thinking. Certainly, as explained in Davis (1971b), students who actively engage in creative activities, such as classroom brainstorming, inevitably show the greatest increments in creative thinking scores. These students learn first-hand what "being creative" is

like; they also learn "flexibility" by observing (or modeling) creative peers and teachers. Accordingly, teachers who allow more classroom group problem-solving are more likely to get results in stimulating creative growth.

Generally, the present research presents positive evidence that the conceptual content of Thinking Creatively is valid, worthwhile, and appropriate for fostering creative growth. The present form—the workbook itself—is not entirely appropriate for sixth- and eighth-grade students reading well below grade level.

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Appendix A
Attitude Questionnaire for All Ss

Name _____ School _____

Sex _____ Grade _____

These questions deal with how you feel about new ideas and thinking. For each question, place a checkmark (✓) in the blank which best describes the degree to which you think that the statement is true. For example:

	Never True				One-Half True				Always True
1. I enjoy new activities.	___	___	___	___	___	___	___	___	___
	1	2	3	4	(5)	6	7	8	9

There are no "right" or "wrong" answers, just be honest.

	Never True				One-Half True				Always True
1. Just about anything in the world could be changed for the better.	1	2	3	4	(5)	6	7	8	9
2. I think I have a good sense of humor.	1	2	3	4	(5)	6	7	8	9
3. When solving problems, thinking of lots of possible ideas is better than sticking with just one that seems right.	1	2	3	4	(5)	6	7	8	9
4. We can improve our ability to think of new ideas.	1	2	3	4	(5)	6	7	8	9
5. Creative thinkers do not spend time on wild ideas.	1	2	3	4	(5)	6	7	8	9
6. I often think about new ideas.	1	2	3	4	(5)	6	7	8	9
7. I think my ideas are about as good as anyone else's.	1	2	3	4	(5)	6	7	8	9
8. Unusual or wild ideas are usually of no help in solving a serious problem.	1	2	3	4	(5)	6	7	8	9
9. Just a few people have the mysterious ability to find really good, new ideas.	1	2	3	4	(5)	6	7	8	9
10. I think I am creative.	1	2	3	4	(5)	6	7	8	9
11. Writers, scientists, and engineers need new ideas, but the average worker doesn't.	1	2	3	4	(5)	6	7	8	9
12. Sometimes I am afraid my ideas mig' + be laughed at.	1	2	3	4	(5)	6	7	8	9

	Never True				One-Half True				Always True
13. Wild ideas can sometimes lead to good ideas.	1	2	3	4	(5)	6	7	8	9
14. It's best to make sure an idea is a good one before suggesting it to a group.	1	2	3	4	(5)	6	7	8	9
15. People can learn to use their imaginations more than they already do.	1	2	3	4	(5)	6	7	8	9
16. I am uncertain about accepting unusual or "way out" ideas.	1	2	3	4	(5)	6	7	8	9
17. I often look for better ways of doing things.	1	2	3	4	(5)	6	7	8	9
18. If I try, I can think of ways to improve almost anything.	1	2	3	4	(5)	6	7	8	9
19. I am confident in my ability to think of new ideas.	1	2	3	4	(5)	6	7	8	9
20. I think I am adventurous.	1	2	3	4	(5)	6	7	8	9

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Appendix B
Supplementary Questionnaire for Ss in Experimental Classes

More Questions

	False	Partly True	True
1. Since reading "Thinking Creatively," I understand where many new ideas come from.	____	____	____
2. Since reading "Thinking Creatively," I can see how important new ideas are in the world.	____	____	____
3. Since reading "Thinking Creatively," I believe I am more creative than I used to be.	____	____	____
4. Now that I've read "Thinking Creatively," I am more interested in new discoveries and inventions than I was before.	____	____	____
5. Now that I've read "Thinking Creatively," I think about new ideas more than I used to.	____	____	____
6. Since reading "Thinking Creatively," I can see more need for new ideas than before.	____	____	____

	No	Sometimes	Yes
7. Was the program, "Thinking Creatively," difficult to read?	_____	_____	_____
8. Was the program, "Thinking Creatively," difficult to understand?	_____	_____	_____
9. Were the exercises too difficult?	_____	_____	_____
10. Compared with other books or workbooks, did you find the program interesting?	_____	_____	_____
11. Compared with other books or workbooks, did you find the program enjoyable?	_____	_____	_____

Appendix C
Follow-up Questionnaire for Teachers of Experimental Classes

To those good-natured teachers who've already donated much valuable time to the testing of "Thinking Creatively," we submit (with duly-gritted teeth) a few brief, but important, last-minute questions. We would greatly appreciate your cooperation in providing us with information (1) concerning possible influences on your students' responses to the attitude survey(s) and the creativity tests, (2) your teaching method (with the program) and (3) your opinion of the material used. Be as brief and informal as you wish, but feel free to comment on anything that you feel is relevant, since you know many things about our program and its use that we do not. Thank you again. (...and SCIENCE thanks you!)

Attitude Questionnaire(s)

1. (a) Did you read the attitude questionnaire items to the class?

   (b) Did students seem to understand the questions? The procedure?

   (c) Were some/any of the items unclear?

2. Do you think that students answered according to what they thought should be the "right" answer? Or did you feel that they tried to be as truthful as possible?

Creativity Tests

3. How were the exercises in the Torrance tests ("Thinking Creatively with Words," Forms A and B) handled? (Did you read the directions to them? Did they seem to understand what was expected? Did they seem to be interested and trying hard?)

Potpourri

4. (8th grade only) What was the nature of the control class? (e.g., math? social studies? English? etc.)

5. (8th grade only) What class was used for the creative thinking experimental group? (e.g., math? social studies? English? etc.)

6. How exactly (but in a sentence or two) did you use the program? (Did you read it to them, or read it together, as a class? Did the students read it at home, on their own? Were the exercises done and/or discussed in class or did the student do the exercises on his own time? Did you or the students elaborate on or make up your own problems, using techniques in the program? Anything else?)

7. (a) Was the program difficult for your students to read?

   (b) Did (most/all) students seem to understand the main principles and procedures?

   (c) Did they seem to enjoy the workbook (at least compared to other instructional materials)?

8. Do you feel (most/all) students benefitted from the experience?

9. Was there much discussion of either the particular chapter or the exercises?

10. Any other general comments, qualifications, criticisms, strong points, weak points, etc.?

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